

OPTIMIZED NUTRIENT AND CROP MANAGEMENT OPTIONS FOR ENHANCING PRODUCTIVITY OF SESAMUM UNDER RAINFED VERTISOL THROUGH FARMERS PARTICIPATORY APPROACH

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ABSTRACT

Sesamum (Sesamum indicum L.) is one of most important oil seed crop of India and grown in about 1.8 million hectares with a total production of 0.76 million tonnes and productivity of 422 kg/ha (FAI, 2011). The major constraint responsible for lower yield are inappropriate production technologies viz., low yielding local varieties, broadcast sowing, poor nutrient and weed management. The survey conducted at Virudhunagar district indicated that Sesamum is grown as late sown catch crop or crop grown in residual moisture in marginal black cotton soil without major nutrient application. The past researches also reported that the yield of Sesamum can be increased by 21 to 53% with adoption of improved crop management technologies. In this context, Front Line Demonstrations (FLD) were conducted by Krishi Vigyan Kendra, Tamil Nadu Agricultural University, Aruppukottai, at 30 locations in Virudhunagar district during Rabi 2011-12, to demonstrate optimized nutrient and crop management packages for maximizing the Sesamum productivity under rainfed vertisol conditions through Farmers Participatory Approach. The optimized nutrient and crop management includes, improved Sesamum variety TMV 7, line sowing, seed treatment, application of single super phosphate as EFYM, recommended dose of fertilizer (17:13:13 N:P:K kg ha⁻¹) along with MnSO₄ and 25 per cent additional dose of N for low N status, were demonstrated as a package. An average, 690 kg ha⁻¹ of Sesamum yield was recorded in demonstrated field which was 71 per cent higher than local check plot (404 kg ha⁻¹). The results from the Sesamum FLDs clearly inferred that the location specific optimized crop nutrient management package was superior to farmer practice in Sesamum growth, yield and economics and the package can be adopted to increase the Sesamum productivity under rainfed vertisol condition of Virudhunagar district.

KEYWORDS: Sesamum , Optimized Nutrient and Crop Management , Rainfed , Vertisol

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INTRODUCTION

Sesamum (*Sesamum indicum* L.) is a short duration crop grown throughout the year which belongs to the family Pedaliaceae. The Sesamum seed is a rich source of edible oil and oil content generally varies from 46 to 52%. Sesamum is one of oldest and most important oil seed crop of India. Sesamum is grown in India in Kharif, rabi and summer season. Normally the crop is grown in plains but it also comes up successfully upto 1200m above mean sea level. It is grown in about 1.8 million hectares with a total production of 0.76 million tonnes and

productivity of 422 kg/ha (FAI, 2011). India ranks first in terms of Sesamum growing area and second largest producer of Sesamum in the world. The major Sesamum producing states are West Bengal, Rajasthan, Madhya Pradesh, Gujarat, Uttar Pradesh, Tamil Nadu, Maharashtra and Karnataka. However, a distressing feature is the productivity of Sesamum in these states is very low. The major constraint responsible for lower yield are inappropriate production technologies viz., non availability of quality seeds, broadcast method of sowing, less fertilizer application and poor weed management. Many earlier studies inferred that the yield of Sesamum can be increased by 21 to 53% with adoption of improved technologies such as improved variety, recommended dose of fertilizer, weed management and plant protection.

Virudhunagar is a rain fed district in Tamil Nadu, growing Sesamum as rabi crop. The Sesamum cropping area is ranged from 1000 to 2000 ha with a productivity of 200 – 300 kg per hectare depending upon the rain received during the period (Hand book of Tamil Nadu Statistics, various issues, latest by 2014). The preliminary survey inferred that about 73 per cent farmer growing Sesamum are small farmers, nearly 82 per cent of the farmers' are getting the productivity of 410 – 520 kg ha⁻¹ and remaining 18 per cent of the farmers have the average productivity between 520 to 700 kg ha⁻¹. The farmers also indicated that lack of knowledge in recent technologies, reuse of own seed materials for sowing and low access to credit were the constraints for them.

The survey also inferred that Sesamum is grown as late sown catch crop or crop grown in residual moisture of marginal black cotton soil without major nutrient applications which resulted in low yield. Though numerous technologies have been developed, the gap between potential and actual yield is still wider. The main reason for the failure of technologies which "identified as successful" is due to wrong selection and partial adoption of technological packages.

The location specific technologies with proper demonstration through participatory approach might be the solution to improve the Sesamum productivity under rainfed vertisol of Virudhunagar District. In this context, Front Line Demonstrations (FLD) with optimized nutrient and crop management package were conducted at 30 locations of Virudhunagar district for maximizing the Sesamum productivity through Farmers Participatory Approach, is discussed hereunder.

METHODOLOGY

Front Line Demonstrations (FLD) were conducted at 30 locations in three blocks of Virudhunagar district during 2011-12 by Krishi Vigyan Kendra, Aruppukottai to demonstrate optimized nutrient management package to maximize the Sesamum productivity and to conserve the soil fertility. The study area belongs to Southern agro climatic zone of Tamil Nadu and the annual rainfall is 814 mm and the North East Monsoon (NEM) contributes 375mm of rainfall. Fortunately, the demo year 2011 -12 was excess rainfall year and recorded 540mm during NEM out of 940 mm of annual rainfall. The soil fertility status of all the thirty locations and check plots were low in available N, medium in available P and high in available K.

Initially, a farmer and scientist interaction meeting followed by a survey were conducted to identify the factors of Sesamum yield reduction at Virudhunagar district. The interaction and survey revealed that the use of local varieties, improper fertilizer usage, poor weed management and labour shortage. Based on the information, the optimized nutrient and crop management package was developed.

The package includes improved Sesamum Variety (TMV 7), seed rate @ 5 kg ha⁻¹, line sowing at 30 x 10cm, seed treatment with bio fungicide *Pseudomonas* followed by biofertilizer *Azospirillum* and basal application of TNAU RDF

(17:13:13 N:P:K kg ha⁻¹). In the fertilizer application, P was applied as Single Super Phosphate @ 81 kg ha⁻¹ through Enriched Farm Yard Manure (EFYM @ 750 kg ha⁻¹), Urea @ 38 kg ha⁻¹ mixed with 2 kg neem cake and MnSO₄ @ 5 kg ha⁻¹. Since the soil available N status was low, a 25% extra dose N (10 kg ha⁻¹ urea mixed with 1 kg neem cake) was given as top dressing after first weeding and one foliar spray of DAP at flowering stage. This package was demonstrated in one acre each of thirty farmer fields of Aruppukottai, Thiruchuzhi and Kariyapatti blocks of Virudhunagar district. Three check plots, each one per block with local practices (Local variety, No seed treatment and No fertilizer management) were also maintained for comparison.

RESULTS AND DISCUSSIONS

The data on growth and yield parameter were collected and the plant height at flowering stage, dry matter production (DMP) at harvest, grain yield, economic indices such as net return and Benefit Cost (B:C) ratio of both demonstrations and check plots were presented in Table 1.

The Sesamum plant height of 30 demo plots at flowering stage was ranged from 63 to 86 cm and the mean value was 74 cm, whereas the check plot mean value was 62 cm. An over all, there was 18 per cent increase in plant height was observed due to location specific optimized crop nutrient management package. The DMP of demo plots was ranged from 2085 to 2738 kg ha⁻¹ and the mean value was 2444 kg ha⁻¹. The average DMP of three check plots was 1717, which was 42 per cent lesser than the improved technological options. The 25 per cent additional nitrogen applied in the demo plots to meet out the low soil N status might be the reason for increased plant height and DMP.

The yield parameters viz., number of capsule per plant, test weight (g) and yield (kg ha⁻¹) were followed the same trend of growth parameters. The maximum, minimum and average number of capsules per plant in demo plots was recorded as 55, 41 and 49, respectively. The highest, lowest and average test weight of demo plots was observed as 3.0, 2.6 and 2.8 g respectively. In check plots it was recorded that the average number of capsules and test weight were 38 numbers and 2.3 g. The improved technologies particularly the nutrient management options such as phosphorous in EFM, neem coated urea and in particular the foliar spray of DAP at flowering stage were contributed the 27 per cent increase in Capsules per plant and 21 per cent increase in test weight over check plots. There was more number of poor filled grains were observed in the check plot, which reduced the test weight of check plots.

The increase in capsule per plant and test weight in demo plant resulted in an average of 71 per cent yield increase in demo plots over check plots. The maximum, minimum and average Sesamum yield recorded due to improved crop and nutrient technological options were 837, 552 and 690 kg ha⁻¹, respectively. The average check plot yield recorded was 404 kg ha⁻¹.

The same was reflected in economics and there were 71, 113 and 32 per cent increase in demo plots' gross income, net income and B:C ratio, respectively than check plots. In values, the demo plots had recorded gross income of Rs. 31056/-, net income of Rs. 19266/- and B:C ratio of 2.6, where as it were 18165/-, 9082/- and 2.0 respectively, in check plots.

The results from the Sesamum FLDs clearly inferred that the location specific optimized crop nutrient management package was superior to farmer practice in Sesamum growth, yield and economics. The increase in growth and yield due to improved nutrient management was supported by Chandrasekhar and Bangarusamy (2003) and Dixit and Elamathi (2007). They pointed out the facts such as enhanced cell elongation, synthesis of carbohydrates and

photosynthetic activity due to optimum nutrient management. In general, both water and nutrient availability should not be limited particularly during the critical stages of the crop. Under rainfed vertisol conditions the moisture availability and soil calcareous restricts the plant roots to uptake essential nutrients. Under such circumstances foliar spray enables the plant to intake the nutrients through foliage and meet out their requirements. Paramasivam *et al* (2003) inferred that, in Sesamum, besides the recommended dose of NPK fertilizers, a seed treatment and foliar spray of nutrients and phyto-hormones increased seed yield by 30.5 per cent as compared to recommended dose of fertilizers alone. In this FLD, combined application of RDF @ 17:13:13 NPK kg ha⁻¹ and one foliar application of DAP @ 2 % during the flowering stage resulted in better nutrient partitioning in plant and thus recorded the higher yield than farmers practice.

The Sesamum yield recorded in the location specific optimized crop nutrient management package FLD in three blocks, each with 10 demo plots was grouped as 550-625, 625-700, 700-775 and 775-850 kg ha⁻¹, depicted in Figure 1.

In general, 36 per cent of demo plot farmers were obtained the Sesamum yield ranged between 625 and 700 kg ha⁻¹, 20 per cent farmers obtained between 701 and 775 kg ha⁻¹ and 17 percent farmers obtained between 775 – 850 kg ha⁻¹. Still there was 27 per cent of farmers received the Sesamum yield ranged between 550 and 625 kg ha⁻¹, need to be concentrated to improve the average Virudhunagar district productivity.

Table 1: Effect of Optimized Crop and Nutrient Management Practices on Growth and Yield Parameters of Sesamum

Block	Plant Height	DMP	Capsules per Plant	Test Weight	Yield	Gross Income	Net Return	B:C Ratio
	cm	kg ha ⁻¹	Nos. plant ⁻¹	g	kg ha ⁻¹	Rs.	Rs.	
Aruppukottai								
Mean	75	2420	48	2.8	689	31019	19229	2.6
Maximum	84	2638	53	2.9	770	34650	22860	2.9
Minimum	63	2085	41	2.7	552	24840	13050	2.1
Local check	61	1670	37	2.3	406	18270	8470	1.9
% Increase Over Check	23	45	30	20.5	70	70	127	41.1
Kariyapatti								
Mean	74	2485	49	2.8	708	31860	20070	2.7
Maximum	86	2738	55	3.0	837	37665	25875	3.2
Minimum	65	2242	43	2.6	614	27630	15840	2.3
Local check	64	1758	39	2.5	417	18765	9415	2.0
% Increase Over Check	15	41	25	14.7	70	70	113	34.6
Thiruchuli								
Mean	73	2425	49	2.7	673	30290	18500	2.6
Maximum	83	2720	54	3.0	831	37395	25605	3.2
Minimum	66	2264	45	2.6	599	26955	15165	2.3
Local check	62	1724	39	2.1	388	17460	9360	2.2
% Increase Over Check	17	41	26	27.7	73	73	98	19.2
Average of 3 Blocks								
Demo	74	2444	49	2.8	690	31056	19266	2.6
Check	62	1717	38	2.3	404	18165	9082	2.0
% Increase Over Check	18	42	27	21	71	71	113	32

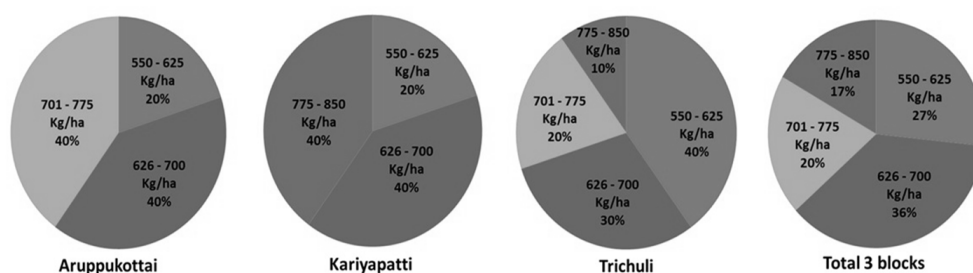


Figure 1: Sesamum Yield(kg ha⁻¹) Level of Demo Plots Using Improved Production Technology
 Check Plots Yields : Aruppukottai- 406 kg ha⁻¹, Kariyapatti- 417 kg ha⁻¹; Trichuli-388 kg ha⁻¹

CONCLUSIONS

The optimized nutrient and crop management package which includes improved Sesamum variety TMV7, seed rate @ 5 kg ha⁻¹, seed treatment with bio fungicide followed by bio fertilizer, line sowing at 30 x 10 cm with thinning, application of RDF fertilizers @ 17:13:13 NPK kg ha⁻¹ with Manganese sulphate, 25 per cent extra dose of N for low N status, application of single super phosphate as EFYM and one foliar spray of 2 per cent DAP at 35 DAS can be adopted as a package to increase the Sesamum productivity under rainfed vertisol condition of Virudhunagar district.

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